Background: The surgical treatment of acetabular fractures relies on the understanding of fracture architecture and their classification. The Judet and Letournel classification has been the cornerstone in understanding and treating acetabular fractures. Recently, there has been growing evidence of discrepancies and incompleteness in the Judet and Letournel classification, adversely affecting its clinical use. This study describes a novel comprehensive classification system that will direct surgical approach and fixation methods.

Methods: A retrospective study of patients with acetabular fractures treated at a level-I trauma center also serving as a referral center for acetabular fractures was performed. Fractures were classified according to both the novel and Judet and Letournel classification systems. The novel classification developed integrates the displacement vector (posterior, superomedial, or combined) and the fractured anatomic structures (anteroposterior wall, pelvic brim, iliac wing, quadrilateral plate, and ischium). Furthermore, postoperative malreduction was evaluated on the basis of intra-articular gap measurements in either anteroposterior or Judet oblique views.

Results: The study included 229 patients with acetabular fractures treated between 2007 and 2016. The mean patient age (and standard deviation) was 46.7 ± 21.75 years, and 172 patients (75.1%) were surgically treated. According to the novel classification system, the posterior displacement vector group included 60 patients, the superomedial displacement vector group included 130 patients, the combined displacement vector group included 36 patients, and 3 patients were unclassified by the new system. Forty-six patients (20.1%) could not be classified by the Judet and Letournel classification. Pelvic-brim fracture patterns were described as along the pelvic brim, across the pelvic brim, or comminuted. The quadrilateral plate primary fracture line was shown to be perpendicular to the pelvic brim. The selection of surgical approach and fixation methods depends on the fracture type.

Conclusions: This study presents a novel classification system for acetabular fractures. It offers a complete classification system, encompassing nearly all fracture patterns. As the selection of surgical approach and fixation methods depends on fracture classification and understanding, the novel classification system can aid the surgeon with decision-making.

Acetabular fractures are among the most challenging fractures encountered by orthopaedic surgeons. Decades ago, Judet and Letournel published their groundbreaking ideas with regard to fracture classification. At the core of their classification system is the concept of the columnar structure of the acetabulum.

The acetabulum is supported by anterior and posterior columns, which further define the anterior and posterior walls as respective rims. Judet and Letournel regarded a column fracture as a complete fracture and a wall fracture as an incomplete fracture.

The Judet and Letournel classification divides acetabular fractures into 2 groups: elementary (simple) and associated (complex). The elementary fracture group includes anterior and posterior wall fractures, anterior and posterior column fractures, and transverse fractures. The transverse fracture is not a simple fracture, but it was included in the elementary fracture group because of its relatively simple geometric shape.

The associated acetabular fracture group includes both-column fractures, anterior column posterior hemitransverse fractures, T-type fractures, and transverse or posterior column with posterior wall fractures. Although all of the first 4 associated fractures involve both the anterior and posterior columns, the both-column fracture pattern is reserved only for fractures leading to discontinuity between the sacroiliac joint and the acetabular joint.

Disclosure: There was no external funding used for this study. The Disclosure of Potential Conflicts of Interest forms are provided with the online version of the article (http://links.lww.com/JBJS/E525).
### TABLE I Fracture Pattern Definition and Classification*

<table>
<thead>
<tr>
<th>Fracture Definition</th>
<th>Patients †</th>
<th>Judet and Letournel Classification ‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior displacement vector group</td>
<td>60 (26.2%)</td>
<td>Posterior wall</td>
</tr>
<tr>
<td>1. Isolated posterior wall</td>
<td>29 (12.7%)</td>
<td></td>
</tr>
<tr>
<td>2. Posterior wall, ischium, and quadrilateral plate if quadrilateral plate is displaced &lt;2 mm</td>
<td>29 (12.7%)</td>
<td>(1) Posterior wall and posterior column; (2) transverse and posterior wall, both if quadrilateral plate is &lt;2 mm</td>
</tr>
<tr>
<td>3. Ischium, with or without quadrilateral plate, without posterior wall</td>
<td>2 (0.9%)</td>
<td>Posterior column</td>
</tr>
<tr>
<td>Superomedial displacement vector group</td>
<td>130 (56.8%)</td>
<td></td>
</tr>
<tr>
<td>1. Iliac wing, pelvic brim, and quadrilateral plate, with or without ischium</td>
<td>70 (30.6%)</td>
<td>(1) Both columns; (2) anterior column posterior hemitransverse</td>
</tr>
<tr>
<td>2. Pelvic brim and quadrilateral plate, with or without ischium; does not include the iliac wing</td>
<td>44 (19.2%)</td>
<td>(1) Transverse; (2) T-type</td>
</tr>
<tr>
<td>3. Pelvic brim and iliac wing</td>
<td>16 (7.0%)</td>
<td>Anterior column</td>
</tr>
<tr>
<td>Combined displacement vector group</td>
<td>36 (15.7%)</td>
<td></td>
</tr>
<tr>
<td>1. Superomedial type 1 and posterior wall</td>
<td>18 (7.9%)</td>
<td>(1) Both columns and posterior wall; (2) anterior column posterior hemitransverse and posterior wall</td>
</tr>
<tr>
<td>2. Superomedial type 2 and posterior wall (quadrilateral plate is displaced ≥2 mm)</td>
<td>18 (7.9%)</td>
<td>(1) T-type and posterior wall; (2) transverse and posterior wall if quadrilateral plate is displaced ≥2 mm</td>
</tr>
</tbody>
</table>

*Three patients (1.3%) had an anterior wall fracture that was not included in the classification. †The values are given as the number of patients, with the percentage in parentheses. ‡The Judet and Letournel classification is included according to the subtypes of the new classification for comparison.

### TABLE II New Fracture Classification According to the Specific Anatomic Structures*

<table>
<thead>
<tr>
<th>Fracture Definition</th>
<th>Pelvic Brim</th>
<th>Iliac Wing</th>
<th>Quadrilateral Plate</th>
<th>Ischium</th>
<th>Posterior Wall</th>
<th>Anterior Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior displacement vector</td>
<td>&lt;2-mm displacement</td>
<td>Mostly (&gt;90%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtype 1: Posterior wall only</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Subtype 2: Posterior wall, ischium, and &lt;2-mm displaced quadrilateral plate</td>
<td>Maybe</td>
<td>No</td>
<td>&lt;2-mm displacement</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Subtype 3: Ischium, without posterior wall</td>
<td>No</td>
<td>No</td>
<td>&lt;2-mm displacement</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Superomedial displacement vector</td>
<td>Always</td>
<td>Always</td>
<td>Always</td>
<td>Maybe</td>
<td>Never</td>
<td></td>
</tr>
<tr>
<td>Subtype 1: Quadrilateral plate, pelvic brim, and iliatic wing, with or without the ischium</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Maybe</td>
<td>No</td>
<td>Maybe</td>
</tr>
<tr>
<td>Subtype 2: Quadrilateral plate and pelvic brim, with or without the ischium</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Maybe</td>
<td>No</td>
<td>Maybe</td>
</tr>
<tr>
<td>Subtype 3: Pelvic brim and iliatic wing</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Maybe</td>
</tr>
<tr>
<td>Combined displacement vector</td>
<td>≥2-mm displacement</td>
<td>Always</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtype 1: Superomedial type 1 and posterior wall</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Maybe</td>
<td>Yes</td>
<td>Maybe</td>
</tr>
<tr>
<td>Subtype 2: Superomedial type 2 and posterior wall (quadrilateral plate is displaced ≥2 mm)</td>
<td>Maybe</td>
<td>No</td>
<td>Yes</td>
<td>Maybe</td>
<td>Yes</td>
<td>Maybe</td>
</tr>
</tbody>
</table>

*Maybe indicates that a fracture of the specific anatomic structure may or may not be included.
The successful reduction of acetabular fractures has been shown to directly relate to clinical outcome scores and the risk of hip arthroplasty. Correct understanding of fracture architecture is cardinal to proper classification. The fracture type dictates the treatment options, from choosing the appropriate surgical approach to reduction techniques and fixation methods.

The Judet and Letournel classification has received much criticism over the years. It is cumbersome and complex, resulting in interobserver agreement of 0.5 to 0.7. Hutt et al. reported that 45% of the studied fractures in their cohort were unclassifiable by >1 researcher.

In this study, a novel classification system for acetabular fractures is presented. This classification system is based on the combination between the displacement vector of the fractures and the specific fracture architectural structures. The new classification was devised with the clinician in mind, to aid with fracture understanding and decision-making with regard to surgical approach and fixation strategies.

### Materials and Methods

#### Study Design

A retrospective study in a level-I trauma center that also serves as a referral center for acetabular fractures was performed. Following approval by the institutional review board, records were reviewed for adult patients (≥18 years of age) with acetabular fractures between 2007 and 2016. The clinical charts and radiographic studies (radiographs and computed tomography [CT] images) were reviewed.

#### Data Collected

Demographic characteristics, clinical data (age at the time of injury, sex, injury side), and treatment type (conservative or surgical) were recorded.

In surgically treated patients, the surgical approach and fixation methods used were recorded on the basis of reviews of clinical charts and radiographic studies.

The preoperative radiographic and CT scans were reviewed by 3 orthopaedic trauma surgeons dedicated to acetabular surgical procedures. Fractures were classified according to both the novel and the Judet and Letournel classification systems. In cases of disagreement about a fracture’s classification, consensus was reached by a joint discussion.

Postoperative malreduction was assessed by measuring the maximal gap of the acetabular articular surface in either the anteroposterior radiographic view or the Judet oblique radiographic view. Digital calibrations of the images were done on the basis of the screw’s diameter. The articular gap measurements were then graded according to Matta as anatomic reduction (up to 1 mm), imperfect reduction (2 to 3 mm), and poor reduction (>3 mm).

#### Novel Classification System

This classification system is based on the combination between 3 possible displacement vectors of the fracture and 6 possible broken anatomic structures.

The anatomic structures include the iliac wing, pelvic brim, quadrilateral plate, ischium, posterior wall, and anterior wall. The fractures were divided into 3 groups according to the direction of the displacement vector. These were the posterior displacement vector group, the superomedial displacement vector group, and the combined displacement vector group.

The first fracture group is the posterior displacement vector group. This group includes subtype 1, which is a fracture only of the posterior wall; subtype 2, which is a fracture of the posterior wall and the ischium, with or without the quadrilateral plate and with or without the pelvic brim, only if the quadrilateral plate was medially displaced <2 mm; and subtype 3, which is a fracture of the ischium and the quadrilateral plate without the posterior wall (formerly a posterior column fracture). Note that fracture subtype 2 includes the posterior wall and the posterior column and some posterior wall and

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**TABLE III Fractures Not Classified in the Judet and Letournel Classification**

<table>
<thead>
<tr>
<th>Fracture Description</th>
<th>New Classification</th>
<th>Patients*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both columns and posterior wall</td>
<td>Combined type 1</td>
<td>11 (23.9%)</td>
</tr>
<tr>
<td>Anterior column posterior hemitransverse and posterior wall</td>
<td>Combined type 1</td>
<td>8 (17.4%)</td>
</tr>
<tr>
<td>T-type and posterior wall</td>
<td>Combined type 2</td>
<td>8 (17.4%)</td>
</tr>
<tr>
<td>Anterior column and quadrilateral plate</td>
<td>Superomedial displacement vector, types 1 or 2†</td>
<td>18 (39.1%)</td>
</tr>
<tr>
<td>Anterior column and anterior wall</td>
<td>Superomedial displacement vector, type 3</td>
<td>1 (2.2%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>46 (100%)</td>
</tr>
</tbody>
</table>

*The values are given as the number of patients, with the percentage in parentheses. †The distinction between superomedial displacement vector subtypes 1 and 2 depends on whether the iliac crest is broken (subtype 1) or not (subtype 2).
Figs. 1-A, 1-B, and 1-C A both-column fracture, superomedial displacement vector subtype 1. Fig. 1-A The fracture starts from the iliac wing and descends along the pelvic brim. Fig. 1-B The angle between the pelvic brim and the quadrilateral plate fracture is marked as alpha. Fig. 1-C The fracture in the posterior column causes discontinuity between the acetabular joint and the sacroiliac joint (red arrow).
Figs. 2-A, 2-B, and 2-C An anterior column posterior hemi-transverse fracture, superomedial displacement vector subtype 1. Fig. 2-A The fracture starts from the iliac wing and descends along the pelvic brim. Fig. 2-B The fracture does not cause discontinuity between the acetabular joint and the sacroiliac joint. The fracture pattern is similar to that of the both-column fracture shown in Figure 1. Fig. 2-C The quadrilateral plate is broken perpendicular to the pelvic brim.
transverse fractures, only if the quadrilateral plate is displaced <2 mm.

Superomedial displacement vector group fractures are fractures in which the main displacement vector is superomedial. The hallmark of this fracture group is the medial displacement of the quadrilateral plate. Subtype 1 includes the iliac wing, pelvic brim, and quadrilateral plate, with or without the ischium. It includes associated both-column fractures, anterior column posterior hemitransverse fractures, and anterior column with quadrilateral plate fractures when the ischium is not broken. Subtype 2 includes the quadrilateral plate and the pelvic brim, with or without the ischium, not including the iliac wing. It includes transverse and T-type fractures. Subtype 3 includes fractures that start from the iliac wing and descend along the pelvic brim. This subtype does not include the quadrilateral plate. Subtype 3 here is equivalent to anterior column fracture.

The combined displacement vector group includes fractures in which combined force vectors were applied, resulting in substantial superomedial (quadrilateral plate) displacement and posterior wall fractures. In this group, subtype 1 involves superomedial displacement vector subtype 1 and subtype 2 involves superomedial displacement vector subtype 2, both with posterior wall fracture.

Pure anterior wall fractures were not included because of their rare occurrence and to allow symmetry and coherence in the classification.

**Statistical Analysis**

Statistical analysis was performed by an experienced biostatistician using SPSS version 23 (IBM). Continuous variables were reported as the mean and the standard deviation. Categorical variables were reported as counts and frequencies. Comparisons between continuous variables were done using the Wilcoxon-Mann-Whitney rank-sum test. Comparisons between categorical variables were done using the chi-square or the Fisher exact test. The latter was used if cell counts were <5. All p values reported are two-sided. Significance was set at p < 0.05.

**Results**

**Patients**

The study included 229 patients with a mean age of 46.7 ± 21.75 years. Of these, 169 (73.8%) were men and 60 (26.2%) were women. The fracture was on the left side in 108 patients (47.2%) and the right side in 121 patients (52.8%).

**Fracture Types**

In this study cohort, the posterior displacement vector group included 60 fractures (26.2%), the superomedial displacement vector group included 130 fractures (56.8%), and the combined displacement vector group included 36 fractures (15.7%) (Tables I and II). Three fractures were unclassified by the new system.

There were 46 patients (20.1%) with a fracture that could not be classified according to the Judet and Letournel classification. These included mostly anterior column and
Other major subtypes that could not be included in the Judet and Letournel classification are the associated both-column, anterior column posterior hemi-transverse, or T-type with posterior wall fragment fractures. Table III summarizes the nonclassifiable fractures according to the Judet and Letournel system.

**Quadrilateral and Pelvic-Brim Fracture Patterns**

We suggest considering the pelvic brim as the main axis of the pelvis. There are 3 distinct fracture patterns: fractures along the pelvic brim (Figs. 1 and 2), those across the pelvic brim (Figs. 3 and 4), and comminuted pelvic brim fractures. Fractures along the pelvic brim were found in 90.0% of the superomedial displacement vector subtype 1 fracture type and in 87.5% of the superomedial displacement vector subtype 3 fracture type. Fractures across the pelvic brim were found in 52.3% of the superomedial displacement vector subtype 2 and in 55.6% of the combined displacement vector subtype 2. Comminution of the pelvic brim was found in 50.0% of the combined displacement vector

---

**TABLE IV Pelvic-Brim Fracture Patterns**

<table>
<thead>
<tr>
<th>Displacement Vector Group</th>
<th>Along the Pelvic Brim†</th>
<th>Across the Pelvic Brim†</th>
<th>Comminuted Pelvic Brim†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior type 2</td>
<td>0 (0%)</td>
<td>5 (100%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Superomedial type 1</td>
<td>63 (90.0%)</td>
<td>6 (8.6%)</td>
<td>1 (1.4%)</td>
</tr>
<tr>
<td>Superomedial type 2</td>
<td>13 (29.5%)</td>
<td>23 (52.3%)</td>
<td>8 (18.2%)</td>
</tr>
<tr>
<td>Superomedial type 3</td>
<td>14 (87.5%)</td>
<td>2 (12.5%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Combined type 1</td>
<td>8 (44.4%)</td>
<td>1 (5.6%)</td>
<td>9 (50.0%)</td>
</tr>
<tr>
<td>Combined type 2</td>
<td>3 (16.7%)</td>
<td>10 (55.6%)</td>
<td>5 (27.8%)</td>
</tr>
</tbody>
</table>

*Significantly different at p = 0.001. †The values are given as the number of patients, with the row percentage in parentheses.
group subtype 1 fractures (Table IV). These differences in the pelvic-brim fracture pattern were found to be significant ($p < 0.001$).

The quadrilateral plate has a distinct fracture pattern as well; the fracture is perpendicular to the pelvic brim (Figs. 1 through 4). The mean angle between the quadrilateral plate fracture and the pelvic brim was $88.84^\circ \pm 20.12^\circ$.

**Surgical Approaches, Fixation Methods, and Reduction Results**

Of the presented cohort, 172 fractures (75.1%) were surgically reduced and fixed. The surgical approaches and fixation methods used were found to be closely related to the aforementioned classification (Table V). In the posterior displacement vector group (44 patients), all patients underwent surgical procedures that used the Kocher-Langenbeck approach. In the superomedial displacement vector group (76 patients), the predominant surgical approach was anterior intrapelvic with a lateral window in 63 patients (82.9%).

In the combined displacement vector group (32 patients), the anterior intrapelvic approach was used in 17 patients (53.1%), the Kocher-Langenbeck approach was used in 6 patients (18.8%), both anterior intrapelvic and Kocher-Langenbeck approaches were used in 5 patients (15.6%), the extended iliofemoral surgical approach was used in 3 patients (9.4%), and the ilioinguinal surgical approach was used in 1 patient (3.1%).

A summary of fixation devices used is presented in Table V. In each fracture type, either screw or plate fixation was used for each pelvic osseous structure.

In the patients who underwent operative treatment, anatomic reductions ($\leq 1$ mm) were achieved in 135 patients (78.5%), imperfect reductions (2 to 3 mm) were achieved in 23 patients (13.4%), and poor reductions (>3 mm) were achieved in 14 patients (8.1%). In 3 patients, the reduction quality could not be assessed. When the quadrilateral plate was medially displaced $\geq 2$ mm, the use of a quadrilateral plate buttress plate was associated with better reduction, and the

---

**TABLE V Surgical Data According to the New Classification**

<table>
<thead>
<tr>
<th>Operative Treatment (N = 172)</th>
<th>Posterior</th>
<th>Superomedial</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonclassifiable (N = 3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterior Type 1 (N = 48)</td>
<td>45 (93.8%)</td>
<td>24 (75.0%)</td>
<td>11 (78.6%)</td>
</tr>
<tr>
<td>Posterior Type 2 (N = 26)</td>
<td>24 (75.0%)</td>
<td>4 (66.7%)</td>
<td>6 (33.3%)</td>
</tr>
<tr>
<td>Superomedial Type 1 (N = 32)</td>
<td>1 (3.3%)</td>
<td>4 (66.7%)</td>
<td>2 (11.1%)</td>
</tr>
<tr>
<td>Superomedial Type 2 (N = 6)</td>
<td>2 (6.3%)</td>
<td>5 (15.6%)</td>
<td>1 (7.1%)</td>
</tr>
<tr>
<td>Combined Type 1 (N = 14)</td>
<td>1 (7.1%)</td>
<td>1 (7.1%)</td>
<td>6 (33.3%)</td>
</tr>
<tr>
<td>Combined Type 2 (N = 18)</td>
<td>3 (9.4%)</td>
<td>2 (33.3%)</td>
<td>4 (22.2%)</td>
</tr>
</tbody>
</table>

**Surgical Approaches†**

- Anterior intrapelvic approach and lateral window
- Iliotrochanteric
- Kocher-Langenbeck
- Extended iliofemoral
- Kocher-Langenbeck and anterior intrapelvic approach
- Percutaneous with or without lateral window
- Smith-Petersen

**Fixation Devices Used**

- Pelvic-brim (anterior column) screw
- Pelvic-brim (anterior column) plate
- Quadrilateral buttress plate
- Ischial (posterior column) screw
- Ischial (posterior column) plate
- Posterior-wall plate
- Anterior inferior iliac spine screw
- Iliac wing screw
- Iliac wing plate
- Interfragmentary screw

**Reduction‡**

- Anatomic ($\leq 1$ mm)
- Imperfect (2 to 3 mm)
- Poor (>3 mm)

---

*The values are given as the number of patients, with the percentage in parentheses. †Significantly different at $p < 0.001$. ‡Significantly different at $p = 0.039$. 

The quadrilateral plate has a distinct fracture pattern as well; the fracture is perpendicular to the pelvic brim (Figs. 1 through 4). The mean angle between the quadrilateral plate fracture and the pelvic brim was $88.84^\circ \pm 20.12^\circ$. 

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*e8(8)*

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_The Journal of Bone & Joint Surgery_ - jbjs.org 
_Volume 100-A - Number 2 - January 17, 2018_ 
_There is No Column: A New Classification for Acetabular Fractures_
Discussion

In this study, a novel classification for acetabular fractures is presented. The classification has 2 steps: first, identify the primary displacement vector; and second, according to the displacement vector, identify the anatomic structures that are fractured. In this classification, the fractures are first divided into 3 main groups according to the direction of the displacement vector: the posterior displacement vector group (subtypes 1, 2, and 3), the superomedial displacement vector group (subtypes 1, 2, and 3), and the combined displacement vector group (subtypes 1 and 2). Each group has a hallmark feature that is most important. In the posterior displacement vector group, it is the posterior wall fracture; in the superomedial displacement vector group, it is the medially displaced quadrilateral plate and superiorly displaced pelvic-brim fractures; and in the combined displacement vector group, it is a combination of a posterior wall fracture and a medially displaced quadrilateral plate fracture.

The classification continues the work of Tile, and the posterior displacement vector group can be viewed as including fracture types α3,β3, and the superomedial displacement vector group can be viewed as including fracture types α2,β2. However, Tile’s classification continues to describe the acetabulum of the femoral-head chondral lesion or marginal impaction as part of the basic classification; these are factors not included in the classification proposed here.

In the suggested classification, the fracture groups are then further divided into subcategories. In the posterior displacement vector group, subtypes are based on whether there is an ischial fracture (posterior column or transverse fracture). In a superomedial displacement vector group fracture, the subtypes are determined according to whether the fracture pattern starts from the iliac wing and goes down along the pelvic brim, meeting the quadrilateral plate fracture in the acetabulum (subtype 1), or, alternatively, if the fracture is through the pelvic brim, continuing the quadrilateral plate fracture line (subtype 2). The combined displacement vector group includes fracture subtypes similar to the superomedial group (subtypes 1 and 2) with an additional posterior wall fracture.

The novel classification system offers a more comprehensive approach to acetabular fractures, as it suggests the surgical approach and/or fixation methods to be used. In the posterior displacement vector group, the surgical approach should be Kocher-Langenbeck and fixation to the posterior wall must be included. For the superomedial displacement vector group and the combined displacement vector superomedial fracture group, the anterior intrapelvic approach should be used because it allows better reduction of the medial displacement, with a buttress plate on the quadrilateral plate to reduce and fix the medial displacement. We have shown that using a quadrilateral plate buttress plate leads to better reduction. The infrapéritoineal buttress plate is placed parallel to the pelvic brim. It is successful in reducing the medial displacement of the quadrilateral plate fracture because the fracture is perpendicular to the pelvic brim. Other well-established techniques are also available for quadrilateral plate buttressing. This is especially important in subtype 2 of either the superomedial group or combined group fractures (transverse and T-type with or without posterior wall fractures), in which Matta indicated that he usually uses the Kocher-Langenbeck posterior surgical approach.

Furthermore, the novel classification system is more complete and inclusive compared with the traditional Judet and Letournel classification. Hutt et al. reported the examination of 100 images of acetabular fractures by several orthopaedic surgeons dedicated to acetabular fractures treatment. In their initial assessment, 46% of acetabular fractures were thought to be unclassifiable by >1 surgeon. There was moderate agreement on which these were (kappa = 0.42). Authors reported that the unclassifiable fractures were 65% anterior column and quadrilateral plate fractures, 26% incomplete fracture lines, and 9% fractures with extensive comminution.

In the current study, one-fifth (20%) of fractures were deemed nonclassifiable by the Judet and Letournel classification. For example, the important both-column, anterior column posterior hemitransverse, or T-type with posterior wall fractures are not included in the traditional classification.

Our proposed classification does not represent a mere change of semantics; the new classification not only represents a terminology change but also reflects a change in the thought process with regard to acetabular fractures. That is, language is not only a communication method; it is thought itself. The primary displacement vector might offer better understanding and surgical decision-making. For example, a failure to acknowledge that a both-column fracture has a posterior wall component, making it a combined displacement vector fracture, might lead to suboptimal reduction and might adversely affect its outcome. For the latter fractures, we suggest using a dual surgical approach, anterior intrapelvic for reduction of the superomedial displacement and Kocher-Langenbeck for reduction and fixation of the posterior wall. It is interesting to note that even Judet and Letournel, in their book, acknowledged that 15.5% of the both-column fractures have a posterior-wall component. Because this modification would require different management, we believe that it needs to be included in the classification.

Another fracture type that is not included in the Judet and Letournel classification is when the ischium is intact and the quadrilateral plate is fractured and is displaced medially. In the novel classification system, these fractures are included as part of the superomedial displacement vector group subtypes 1 or 2, depending whether the iliac wing is broken or not.
The current study also points to the fact that the pelvic brim has a standard fracture pattern, either along or through the brim. Furthermore, the quadrilateral plate’s typical fracture pattern is perpendicular to the pelvic brim. Because of the quadrilateral plate’s typical fracture pattern, our preferred technique for its fixation is an intrapectineal buttress plate placed parallel to the pelvic brim. Data presented in the study show that the presented technique helps to achieve and maintain better reduction.

This study had several limitations. First, it was a retrospective study in which not all data were available for all of the patients, such as clinical outcome scores. However, classification studies are often retrospective, because the creation of a classification is a retrospective process, reflecting on fractures and analyzing them. Second, evaluation of the classification in terms of interobserver agreement was not performed and should be done by an independent researcher group.

Further studies are required to evaluate the proposed novel classification. Comparing the interobserver agreement, the additional data obtained by 3-dimensional CT, and its overall effect on clinical outcomes should be assessed in future studies.

References
